Comparison of Video-Based Learning versus Presentations in Lectures Amongst Medical Students in Pharmacology

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ABSTRACT

Innovative teaching methods are constantly being explored to keep students engaged and challenge them academically. This study was done to compare the benefit of video-based learning methods compared to conventional power-point presentations. A total of 150 second-year medical undergraduate students were divided into two groups. Both groups were given a pre-test to test their baseline knowledge of the topic. One group was taught the mechanisms of action of the drugs by using lectures during presentations and the other group was taught with the help of videos. A post-test was conducted and scores from the two groups were compared. Feedback questionnaires were also administered to understand the students’ perception of the two teaching methods. The mean score in the video-based group was 15.59±2.46 and, in the presentation, group was 11.43±1.53, out of a total score of 20. A majority of 77.33% preferred video-based learning techniques. This study shows that conventional teaching techniques no longer suffice in keeping students engaged and novel approaches yield higher scores with a better learning experience. Similar studies exploring newer approaches in education are scarce. The findings of this study can be a jumping-off point for inculcating more creative teaching methods in the classroom.

INTRODUCTION

Learning is the transfer of knowledge and skills through a systematic interaction between teachers and learners. In the modern world, the influence of technology in our lives is undeniable. The subsequent decrease in the attention span has forced us to find new and creative ways to hold the interest of students for prolonged periods. In a field like medical science where every skill and information acquired starting from the first year of M.B.B.S. plays a role in patient management in the entire lifetime of a doctor future doctors need to be trained in the best way possible.

Video-based learning (VBL) method also gives us the benefit to teach and approach large numbers with uniformity and authenticity (Ramaswamy et al., 2019). VBL has unique features that make it an effective learning method. It has the potential to partly replace traditional classroom-based teacher-led learning approaches that are usually accompanied by the use of presentations currently (Merkt et al., 2011). The use of auditory and visual enhancement has already shown benefits, as educators in technologically advanced European universities started using videos back in 1990 (Laurillard, 1995). In India, the first step towards the use of new tools in teaching started with presentations. The use of pictures in presentations improved students’ understanding as compared to the traditional method of classroom teaching. Now with the
development that has taken place over these years, the use of videos for teaching has started in India too. Classrooms are now connected to the internet and interactive digital videos, as well as video conferences, have become possible.

The use of videos to display procedures, signs and symptoms of diseases, and explanations of core concepts even at the molecular level is an important tool for students to increase understanding and develop a long-lasting memory. It helps students visualize the concepts. All the free-access resources that are available on various platforms can be used to provide the best explanation in a very convenient way (Colasante, 2011). Videos also attract students’ attention and encourage them to engage more which can lead to better learning outcomes (Zhang et al., 2006). It has a special role to play especially in the case of higher education where the skills and information you acquire play an important part in future work opportunities.

From a student’s perspective, there has been an increased interest in studying effectively using techniques like mind maps, active recall and the Pomodoro method compared to conventional rote learning for prolonged periods. A lot more emphasis is placed on productive and meaningful learning that can be retained long-term. To keep up with the needs of the students, teaching techniques should evolve and become more creative.

This cognitive psychology has been adopted into the Mayer’s 12 principles of multimedia learning. The principles were formulated based on certain assumptions, namely the dual-channel assumption: humans have different channels to process images and speech; the limited capacity assumption: we can only process about 5-7 chunks of information at a time; and the active processing assumption: we cannot learn by passively receiving information.

| Principle          | Coherence                                                                 | Signalling                                                                 | Redundancy                                                                 | Spatial contiguity | Time contiguity                                                                 | Segmenting                                                                 | Pre-training                                                                 | Modality                                                                 | Multimedia                                                                 | Personalisation                                                                 | Voice                                                                 | Image                                                                 |
|--------------------|---------------------------------------------------------------------------|----------------------------------------------------------------------------|---------------------------------------------------------------------------|-------------------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------|---------------------------------------------------------------------------|------------------------------------------------------------------|----------------------------------------------------------------------------|
|                    | People learn better when irrelevant information is excluded                | People learn better when important concepts are highlighted             | Graphics and narration are better received when onscreen text is omitted   | Words alongside graphics are read better than words placed separately  | People learn better when corresponding narration is presented simultaneously with graphics/images | People learn better when they are in control of the pacing of the lesson and can place information into segments that are easier to process | Students are benefited from a prior orientation to the lesson – with the help of key terms, handouts, supplementary materials, etc | Graphics are better paired with narrations (to engage the dual channels); onscreen text with graphics might lead to visual information overload | Static Images along with words are received better than words alone | People learn better when information is relayed conversationally | Narration is better with a human voice compared to machine voice |
|                    |                                                                           |                                                                            |                                                                          |                   |                                                                                                                                            |                                                                              |                                                                              |                                                                          |                                                                          |                                                                  |                                                                            |
|                    |                                                                           |                                                                            |                                                                          |                   |                                                                                                                                            |                                                                              |                                                                              |                                                                          |                                                                          |                                                                  | In presentations which are text and image-heavy, it is best to avoid inclusion of the speaker’s face |

(Mayer, 2017; Saeverot & Torgersen, 2016)

There has been a reported need to restructure undergraduate medical education by revising the teaching programs and methodology. While introducing new methods is always a positive step, it is also important for us to assess the impact of these new teaching methods that are being introduced and assess students’ perceptions about the same as it will help us strengthen the methods of delivering information. Hence, this study was planned to do a comparative analysis between the methods of teaching through presentations or video-based learning on students’ understanding and also get insight into students’ perception towards these methods. Teachers can modify the techniques based on the information they get about students' learning styles, which will be a beneficial step in medical education (Vare et al., 2017).
Objectives
1. To assess the impact on learning outcomes from the use of interactive video demonstration techniques versus presentations during lectures.
2. To assess the perceptions of students regarding the use of videos as compared to presentations as a learning modality.

RESEARCH METHOD
Study Design and Setting
This cross-sectional, observational study was conducted at D.Y. Patil deemed to be University, Navi Mumbai, India. The study protocol was approved by the Institutional Ethics Committee (DYP/IECBH/2020/44). Written informed consent was obtained from all the participants before enrolment. All the participants are second-year medical undergraduate students from the same institute.

The participants were divided into two academically validated groups: Group A and Group B. Validation of the groups was done taking into consideration their marks in the first internal assessment. The students were arranged in ascending order of marks and alternate students were assigned to each group.

Both groups had a pre-test on the mechanisms of action of various drugs from different systems. After this, three sessions of one hour each were conducted using presentations on the same topic for Group A and using video-assisted learning methods for Group B. The presentation for Group A consisted of text and pictures about the topic. For group B, videos were used to make students understand the mechanism of action of drugs. A post-test was then taken after all three sessions. The tests were in the form of multiple-choice questions that were distributed through a Google form. Evaluation of the examination was done by using the answer key which had been prepared during question paper validation. The students were marked for each test out of a total score of 20. The marks obtained by the two groups were tabulated and analyzed statistically. Feedback was obtained with the help of a questionnaire in which all the questions had to be answered on a 5-point Likert scale. The questionnaire was pre-validated. The questions were focused on getting an insight into participants' perspective towards the teaching method they were exposed to (i.e., use of presentations during lectures or video-based learning).
Statistical Analysis
Data entry was done on Microsoft Excel and statistical analysis was done on GraphPad Prism version 9.5.0. (GraphPad Software, San Diego, California USA). Continuous data were expressed as means with standard deviation (SD), and between-group comparisons were done using two independent-sample t-tests. Comparison between the pre-test and post-test values of the same group was done by using paired t-test. A 'p-value of ≤0.05 was considered statistically significant. The feedback from students was expressed in percentages.

RESULTS AND DISCUSSION
Results
A total of 150 students were enrolled for the study. Each group had 75 students. All the enrolled students completed the study and were included in the final analysis. The marks obtained by the students out of 20 in both groups were checked for normality that would guide the further statistical tests to be conducted. From the normality tests, it is confirmed that the two groups follow the normal distribution, so we choose the parametric method for analyzing the data. Table 2 shows the participant score in the pre-and post-test in both groups.

Table 2. Participant score (pre- and post- test)

<table>
<thead>
<tr>
<th></th>
<th>Multiple choice questions score</th>
<th>Presentation group (n= 75)</th>
<th>Video-based learning group (n= 75)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td></td>
</tr>
<tr>
<td>Pre-test</td>
<td>8.31 ± 2.50</td>
<td>8.93 ± 2.12</td>
<td></td>
</tr>
<tr>
<td>Post-test</td>
<td>11.43 ± 1.53</td>
<td>15.59 ± 2.46</td>
<td></td>
</tr>
<tr>
<td>p-value</td>
<td>0.03</td>
<td>0.003</td>
<td></td>
</tr>
</tbody>
</table>

Table 2 shows results from paired t-test was used for the above data to compare the pre- and post-test value of each group independently. Post-test scores were significantly higher than the pretest scores in both groups. Although the difference between the pre-test and post-test in the ppt group was significant (p-value is 0.03.), the difference was more statistically significant in the VBL group (p-value is 0.003.)

Table 3. Paired t-test: comparison of pre-test and post-test scores of PPT group.

<table>
<thead>
<tr>
<th></th>
<th>Mean Difference (pre-test minus Post-test)</th>
<th>Standard error of differences</th>
<th>95% CI</th>
<th>t-statistic</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>-3.11</td>
<td>0.557</td>
<td>-5.51 to -0.71</td>
<td>5.58</td>
<td>*P&lt; 0.03</td>
</tr>
<tr>
<td>Post-test</td>
<td>-6.04</td>
<td>0.35</td>
<td>-7.55 to -4.54</td>
<td>17.29</td>
<td>**P&lt; 0.003</td>
</tr>
</tbody>
</table>

Table 4. Paired t-test: comparison of pre-test and post-test scores of VBL group.

<table>
<thead>
<tr>
<th></th>
<th>Mean Difference (pre-test minus Post-test)</th>
<th>Standard error of differences</th>
<th>95% CI</th>
<th>t-statistic</th>
<th>Significance level</th>
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<td>-7.55 to -4.54</td>
<td>17.29</td>
<td>**P&lt; 0.003</td>
</tr>
</tbody>
</table>

Table 5. Unpaired t-test: comparison of mean differences of scores between PPT and VBL group.

<table>
<thead>
<tr>
<th></th>
<th>Mean Difference (VBL- PPT)</th>
<th>Standard error of differences</th>
<th>95% CI</th>
<th>t-statistic</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>2.92</td>
<td>0.664</td>
<td>1.07 to 4.76</td>
<td>4.39</td>
<td>**P = 0.012</td>
</tr>
</tbody>
</table>

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https://scie-journal.com/index.php/SiLeT
Table 6. Post-test scores of the PPT and VBL group.

<table>
<thead>
<tr>
<th>Mean Difference (VBL minus PPT)</th>
<th>4.16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard error</td>
<td>0.335</td>
</tr>
<tr>
<td>95% CI</td>
<td>3.50 to 4.82</td>
</tr>
<tr>
<td>t-statistic</td>
<td>12.43</td>
</tr>
<tr>
<td>Significance level</td>
<td>***P&lt; 0.0001</td>
</tr>
</tbody>
</table>

*P <0.05, ** P <0.01, *** P <0.001

Table 5 From the normality tests, it is confirmed that the two groups follow the normal distribution, so we choose the parametric method for analysing the data. Unpaired statistical t-tests showed the difference in mean scores between the two groups to be 4.16 (95% confidence interval: -3.50 to 4.82, \( p < 0.0001 \)).

Analysis of Feedback

The feedback from the students in each group was obtained on a five-point Likert scale. For each question, students had to select an answer on a scale that had 5 options—Strongly agree, Agree, Neutral, Disagree, and Strongly disagree. A different set of questions were used for the two groups based on the relevance of those to the teaching method used. Figure 1 shows the feedback we obtained from students who underwent video-based learning.

Figure 2. Feedback from students in the video-based learning group
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Discussion
Pharmacology is one of the most important subjects in the entire medical curriculum which is introduced to students during the second year of an undergraduate course at the same time when they start getting clinical exposure through postings in the hospital. Traditionally the subject has been taught with the help of didactic lectures, practical demonstrations, and tutorials in small groups. These methods have always been teacher-centered and learners play a passive role. The field of pharmacology is constantly growing with new drug developments taking place every day. Due to this, the students are overburdened with the content that they must learn and remember and often find it difficult to do the same.

In this study, the mean marks of the students in the post-test taught using the traditional method was 11.43 while for the visually aided method was 15.59. Students scored higher marks in the video demonstration method than in the conventional method of teaching using presentations. According to a similar study conducted in Delhi, the mean test marks were 51.35% using the traditional method and 57.23% using the visually aided method and the difference was statistically significant. The finding in this study agrees with the report of Seth (2010) that students of pharmacology in an Indian Medical College performed better when taught using computer-assisted instruction than the traditional methods (Seth, 2010). A study by Onotai et al. (2012) conducted at the University of Port-Harcourt Medical School in Nigeria found that most students preferred video-based learning and they scored better. A clear increase in academic performance among students receiving visual procedures during theoretical teaching has been observed. This might be due to multimedia tools generating a higher lasting impact on the learner as these tools have a better visual appreciation. The video-based materials have been used as a successful, cost-effective medium with positive benefits of increased concentration, and motivation during learning leading to a higher impact on understanding and retention (Choi & Johnson, 2007). Coyne et al. (2018) similarly found that video-based learning improved the knowledge and skill of students and is a preferred method due to its flexibility.

Students perceived video-based to be a better learning method than the presentation method. 93.33% of students strongly agreed that the VBL method was interesting and 53.33% of students found the presentation method to be non-interesting. 90.6% of students in the VBL group felt that a better understanding of the subject also motivated them to learn more and
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explore the depth of the subject. As compared to this in the presentation group, 61.33% were not motivated to read more. VBL had a higher impact on the learner retention capacity in the acquisition of knowledge (85.33%) which matches with the findings described by Subhash et. al. (2018), while 78.66% of students in our study said that learning was not easier through the traditional method of teaching through presentations (Subhash et al., 2018). Analysing the result from a student’s point of view it can be understood that 77.33% of students prefer VBL should be continued and regularly implemented. A need for change in the traditional method of teaching using presentations has been felt by 74.66% of students, which is a staggering figure and due care about this fact needs to be taken to introduce better methods such as video-based learning.

The Future
While video-based learning can be an extremely useful tool in getting students more interested and engaged in the learning process, newer approaches can definitely enhance the experience. ‘Gamification’ in e-learning by means of reward points, leaderboards, challenges, etc can serve to take the mundane task of studying and give it a competitive edge. This serves to motivate students who already find studying rewarding, however. There is the possibility of an over justification effect (decrease in the intrinsic motivation of a learner due to external incentives) (Aguiar-Castillo et al., 2020; Çakıroğlu et al., 2017; Ghai & Tandon, 2023; Gorbanev et al., 2018; Hsu & Chen, 2018; Huotari & Hamari, 2017).

Another step towards enhancing the learning experience is via Immersive virtual reality (IVR) by means of technology like 3D-Head mounted display (HMD). These can provide a better simulation of real-world scenarios that are otherwise impractical to explore for students. This fully engages the visual, auditory and tactile senses of the learner (Di Natale et al., 2020; Makransky et al., 2020; Makransky & Mayer, 2022; Makransky & Petersen, 2021; Parong & Mayer, 2021; Petersen et al., 2022).

This study is not without its limitations. It was conducted at a single medical college in a tier-1 city in India. To get a proper understanding of the acceptability of these new methods, we suggest widespread multicentric study in medical colleges all over the country, having representation from all strata of students and faculty.

CONCLUSION
Video-based learning (VBL) method was found to be more effective than the use of presentations during lectures. It has shown a positive impact on learners' understanding, motivating them to read and learn more about the subject and helping them retain the concepts for a longer period. The students prefer the use of videos frequently and wish for them to be implemented into everyday lectures. More studies can be conducted in the future where we can analyse the long-term impact of using video-based methods which can then act as a guide to bring about a much-needed change in the traditional methods of teaching in medical colleges which has been felt by the students and faculty.

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